Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

7994315301

CHEMISTRY **0620/22**

Paper 2 **October/November 2015**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 16.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

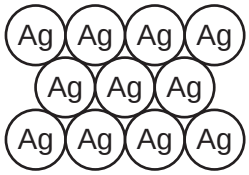
This document consists of **14** printed pages and **2** blank pages.

© UCLES 2015

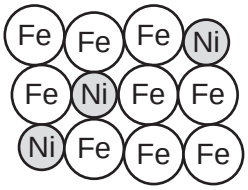
CAMBRIDGE International Examinations

1 The structures of six substances are shown below.

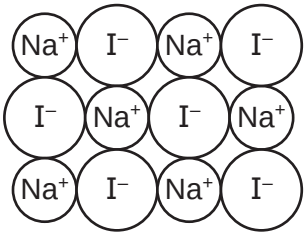
A



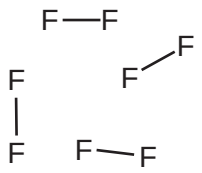
B



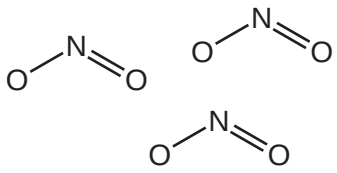
C



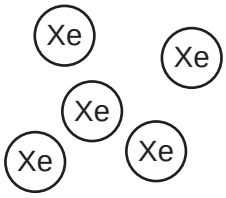
D



E



F



Answer the following questions about these substances.
Each substance may be used once, more than once or not at all.

(a) Which substance, **A**, **B**, **C**, **D**, **E** or **F**,

(i) is a simple molecular compound, ... [1]

(ii) is an alloy, ... [1]

(iii) is a compound, whose aqueous solution gives a yellow precipitate on addition of aqueous silver nitrate, ... [1]

(iv) is an atmospheric pollutant arising from reactions taking place in car engines, ... [1]

(v) is a diatomic molecule, ... [1]

(vi) conducts electricity when molten but not when solid? ..... [1]

(b) Substance **A** is an element.

What is meant by the term *element*?

.....

..... [1]

(c) Substance **D** oxidises water to oxygen.

Complete the symbol equation for this reaction.

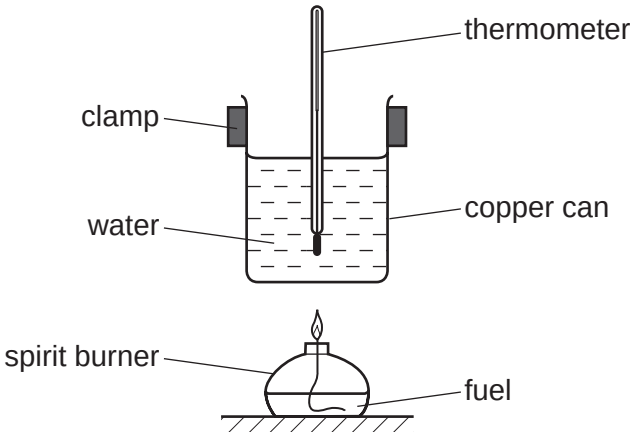
$$2F_2 + 2H_2O \rightarrow \text{.....}HF + \text{.....}$$

[2]

[Total: 9]

© UCLES 2015

2 A student measured the highest temperature reached when four different fuels were burned. He used the apparatus shown below.



(a) The same amount of each fuel was burned.

Suggest **two** other things which the student should keep constant to make the experiment a fair test.

1. .....

2. .....

[2]

(b) Is burning an exothermic or an endothermic reaction?
Give a reason for your answer.

..... [1]

(c) The table below shows the results.

fuel	molecular formula	initial temperature / °C	final temperature / °C
ethanol	C_2H_6O	23	44
hexane	C_6H_{14}	17	46
pentane	C_5H_{12}	22	48
propanol	C_3H_8O	21	45

(i) Which fuel gave the highest temperature change?

..... [1]

(ii) Which fuel has the highest relative molecular mass?
You are not expected to do any calculations.

..... [1]

© UCLES 2015

[Turn over

(d) Methane is a fuel.

(i) Draw the structure of methane showing all atoms and all bonds.

[1]

(ii) Which **one** of the following fuels is largely methane?
Tick **one** box.

coal	☐
fuel oil	☐
gasoline	☐
natural gas	☐

[1]

(e) Pentane and hexane belong to the same homologous series.

(i) How can you tell this from their names?

..... [1]

(ii) Complete the following sentence about a homologous series using words from the list below.

acidic	**alcohol**	**compounds**	**density**	**different**
elements	**functional**	**masses**	**properties**	**solid**

A homologous series is a family of similar ..... with similar .....

due to the presence of the same ..... group.

[3]

[Total: 11]

© UCLES 2015

3 The order of reactivity of zinc, magnesium, calcium and barium is shown below.

zinc → magnesium → calcium → barium

least reactive ⟶ most reactive

(a) Equal-sized pieces of zinc, magnesium, calcium and barium are placed in water. Some observations from these reactions are shown in the table.

(i) Complete the box for barium.

metal	observations
zinc	no reaction with cold water
magnesium	gives a few bubbles with hot water, does not disappear
calcium	gives off bubbles steadily with cold water, gets smaller slowly
barium	

[2]

(ii) Give the name of a metal in the above table which is extracted by heating with carbon.

..... [1]

(iii) Suggest why barium cannot be extracted using carbon.

..... [1]

(b) Barium can be extracted by heating barium oxide with aluminium.

$$4BaO + 2Al \rightarrow 3Ba + BaAl_2O_4$$

How does this equation show that barium oxide gets reduced?

..... [1]

(c) A solution of barium hydroxide is alkaline.

(i) Describe how you would show that barium hydroxide solution is alkaline.

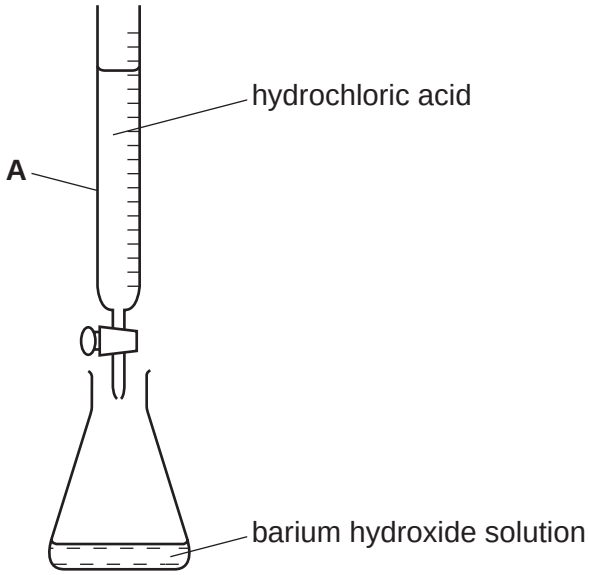
..... [1]

(ii) Complete the word equation for the reaction of barium hydroxide with hydrochloric acid.

barium hydroxide + hydrochloric acid → ..... + ...

[2]

(d) A student used the apparatus shown below to calculate the concentration of barium hydroxide solution.



(i) Give the name of the piece of apparatus labelled **A**.

..... [1]

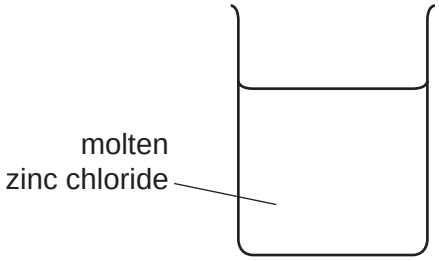
(ii) The hydrochloric acid is added to the barium hydroxide solution in the flask until the acid is in excess.

Describe how the pH of the solution changes as the acid is added.

.....

..... [2]

(e) Complete the diagram below for the electrolysis of molten zinc chloride.
Label the electrodes and the power source.



[3]

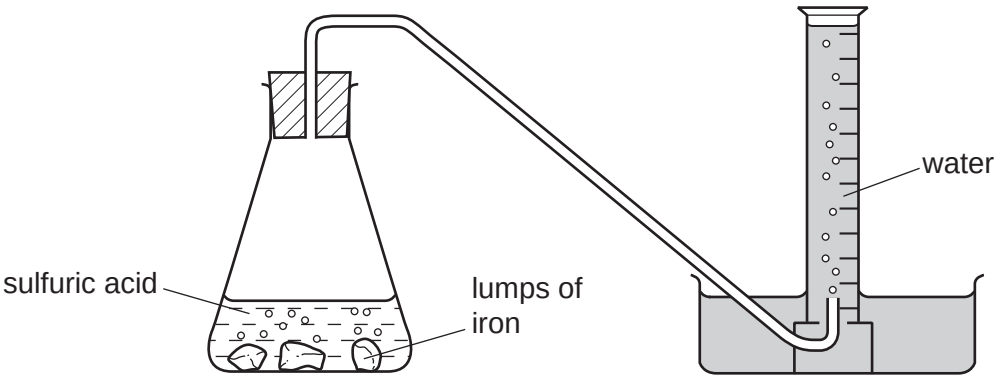
[Total: 14]

© UCLES 2015

4 A student investigated the reaction of lumps of iron with sulfuric acid.

$$Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$$

She used the apparatus shown below.



(a) (i) Describe how this apparatus can be used to investigate the rate of this reaction.

.....

.....

..... [3]

(ii) Describe how the rate of reaction would differ if smaller lumps of iron were used. All other conditions remain the same.

..... [1]

(b) The student investigated the effect of temperature on the reaction rate.

(i) State **three** factors which the student should keep the same in each experiment.

1. .....

2. .....

3. .....

[3]

© UCLES 2015

[Turn over

(ii) The table shows how the rate of reaction changed with temperature.

temperature / °C	rate of reaction in cm^3/s
20	2.2
30	4.4
40	8.8
50	17.6

Use the information in the table to describe how the rate of reaction changed with temperature.

.....

..... [2]

(c) Iron(II) sulfate can be prepared by adding excess iron to sulfuric acid.

Describe how you could obtain pure dry crystals of iron(II) sulfate from the reaction mixture in the conical flask.

.....

.....

.....

..... [3]

[Total: 12]

© UCLES 2015

5 A crystal of sulfur melts when heated.

(a) Explain, using the kinetic particle theory, the differences between the arrangement and motion of the particles in sulfur crystals and liquid sulfur.

.....

.....

.....

.....

..... [4]

(b) Sulfur dioxide is an atmospheric pollutant.

(i) Describe how sulfur dioxide is formed and how it gets into the atmosphere.

.....

.....

..... [2]

(ii) What type of oxide is sulfur dioxide?

..... [1]

(iii) Flue gas desulfurisation removes sulfur dioxide from exhaust gases in factories.

Describe the process of flue gas desulfurisation.

.....

..... [2]

(iv) Sulfur dioxide is also formed when copper is reduced by hot concentrated sulfuric acid.

Complete the symbol equation for this reaction.

$$Cu + ...H_2SO_4 \rightarrow CuSO_4 + SO_2 + ...H_2O$$

[2]

(c) Copper is a metal.

Give **two** physical properties which are characteristic of all metals.

1. .....

2. .....

[2]

© UCLES 2015

[Turn over

(d) The table below gives some properties of some metals that are used to make electrical cables and wires.

metal	strength	electrical conductivity	melting point / °C	price $/kg
aluminium	comparatively weak	good	660	1.5
copper	strong	very good	1093	29
steel	strong	fairly good	1535	2.1
silver	fairly strong	very good	962	635

(i) Suggest why aluminium with a steel core is used for overhead power cables.

.....

..... [2]

(ii) Copper is used in electrical wiring in the home rather than silver.

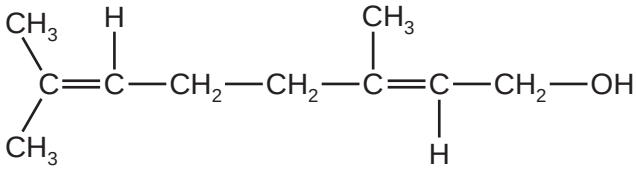
Suggest why.

..... [1]

[Total: 16]

© UCLES 2015

6 Geraniol is a chemical found in rose petals.
The structure of geraniol is shown below.

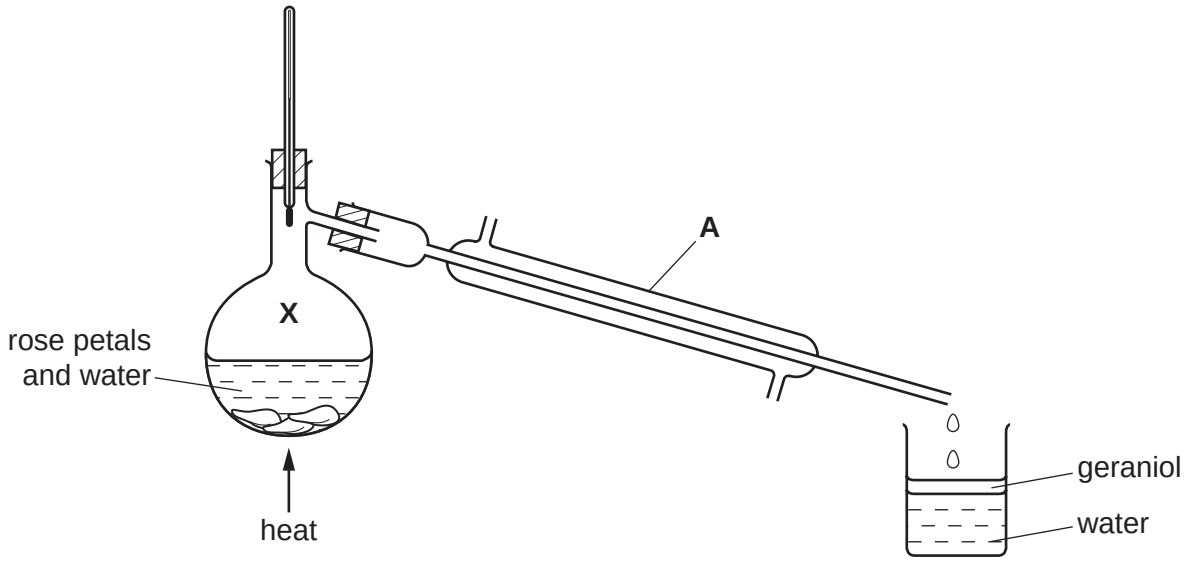


(a) (i) On the structure above, put a ring around the alcohol functional group. [1]

(ii) Is geraniol a saturated or an unsaturated compound?
Give a reason for your answer.

..... [1]

(b) Geraniol can be extracted from rose petals by steam distillation using the apparatus shown below. The geraniol is carried off in small droplets with the steam.



(i) Give the name of the piece of apparatus labelled **A**.

..... [1]

(ii) The vapour at point **X** is a mixture of geraniol and steam.

Give **one** property of a mixture which distinguishes it from a compound.

.....

..... [1]

(iii) The geraniol and water are collected in the beaker.

What information in the diagram above shows that geraniol is less dense than water?

..... [1]

© UCLES 2015

[Turn over

(c) Geraniol can also be extracted from rose petals by grinding the petals in ethanol.

(i) Draw the structure of ethanol showing all atoms and all bonds.

[1]

(ii) Complete the word equation for the complete combustion of ethanol.

ethanol + oxygen $\rightarrow$ ..... + ...

[2]

(d) What is the percentage by volume of oxygen in the air?

..... [1]

[Total: 9]

© UCLES 2015

7 Beryllium is in Group II and Period 2 of the Periodic Table.

(a) Describe the structure of a beryllium atom.
In your answer, refer to

- the type and number of each subatomic particle present,
- the charges on each type of subatomic particle,
- the position of each type of subatomic particle in the atom.

.....

.....

.....

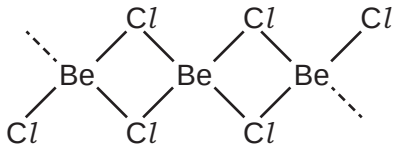
.....

.....

.....

..... [5]

(b) Part of the structure of beryllium chloride is shown below.



Deduce the simplest formula for beryllium chloride.

..... [1]

(c) Beryllium carbide, Be_2C, reacts with water. Beryllium hydroxide and methane are formed.

$$Be_2C + 4H_2O \rightarrow 2Be(OH)_2 + CH_4$$

(i) Calculate the relative formula mass of beryllium hydroxide.

[2]

(ii) Describe **one** adverse effect of methane on the environment.

..... [1]

[Total: 9]

© UCLES 2015

BLANK PAGE

© UCLES 2015

BLANK PAGE

© UCLES 2015

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II									III	IV	V	VI	VII	0		
															4 He Helium 2		
					1 H Hydrogen 1												
7 Li Lithium 3	9 Be Beryllium 4									11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10		
23 Na Sodium 11	24 Mg Magnesium 12									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18		
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

*58-71 Lanthanoid series	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
†90-103 Actinoid series	232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.